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-	2	5963799.pn. and substrate	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/02/28 10:22
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-	0	2314974.URPN.	USPAT	2003/02/28 10:22
-	1	1998-045052.NRAN.	DERWENT	2003/02/28 10:22
-	0	"retrograde well is"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/02/28 11:41
-	0	"retrograde wells are"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/02/28 11:41
-	305	retrograde adj well	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/02/28 11:41
-	51	(retrograde adj well) and twin	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/02/28 11:55
-	2	6249025.pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/02/28 11:55

US-PAT-NO: 4767721

DOCUMENT-IDENTIFIER: US 4767721 A

TITLE: Double layer photoresist process for well self-align and ion implantation masking

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The assignee of the present invention is presently employing a self-aligned process for fabricating circuits having twin retrograde wells. "Retrograde" refers to the dopant impurity concentration profile wherein the concentration is highest at a distance below the wafer surface. As is known, using a retrograde twin-well profile facilitates the prevention of circuit "latch-up." To obtain the retrograde profile, high energy ion implantation is typically employed, which requires that the masks used to define the active area provide adequate shielding against the implantation process. Moreover, the process presently employed by the assignee requires separate masks be employed to define the p and n well regions. The use of separate masks leads to alignment difficulties, increases the complexity and number of process steps and reduces circuit densities.

A double layer photoresist and metal lift-off technique is employed for p-well masking and ion implantation in the fabrication of a twin-well CMOS structure. The wafer is coated with two layers of two different photoresist materials to achieve a substantially planar top surface. During this step, a high temperature treatment of the bottom layer of the photoresist is carried out.

After the top layer of photoresist is applied and patterned by a conventional
p-well mask technique, the wafer is exposed by blanket deep UV radiation, and
the bottom layer of photoresist is developed through the opening pattern formed
in the top layer. The resulting double layer photoresist pattern can sustain
high dose and high energy Boron ion implantation up to 2.times.10.sup.14
ions/cm.sup.2 and 380 Kev needed for deep retrograde wells. After the p-well
ion implantation, a thick layer of aluminum is deposited over the wafer,
resulting in a first layer covering the exposed p-well region, and a second
layer, covering the photoresist layers and elevated above the first metal layer
as a result of the double photoresist layers. A selective metal lift-off
procedure then follows. The metal left on the surface forms a conjugate
pattern of the p-well and serves as the n-well mask for subsequent n-well
implantation. As a result of the process, a self-aligned twin-well structure
is formed.